Greenhouse Gas Regulations and Title V Permitting

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Housekeeping

- All lines will be muted.
- Questions can be sent to us via the question box.
- The webinar is being recorded.

Goal

- Provide overview of how GHG regulations affect Title V permitting.
- Explain options to comply.

Agenda

- Terminology
- Brief background on Tailoring Rule
- Title V Implications of Tailoring Rule
- Who is Affected
- What you need to do

Terminology

Greenhouse Gas (GHG)

- GHGs are considered the sum of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
- GHGs are primarily emitted by the combustion of fossil fuels.

Terminology

Carbon Dioxide Equivalent (CO_2e)

- Internationally recognized measurement for GHGs. When quantities of the different GHGs are multiplied by their global warming potentials (GWPs), the different GHGs can be summed and compared on a CO_2e basis.

Terminology

TABLE A–1 TO SUBPART A OF PART 98—GLOBAL WARMING POTENTIALS

[100-Year Time Horizon]

			Global warming
Carbon dioxide	124–38–9	CO_2	1
Methane	74–82–8	CH_4	21
Nitrous oxide	10024–97–2	N_2O	310
HFC–23	75–46–7	CHF_3	11,700
HFC–32	75–10–5	CH_2F_2	650
HFC–41	593–53–3	CH_3F	150
HFC–125	354–33–6	C_2HF_5	2,800
HFC–134	359–35–3	$C_2H_2F_4$	1,000
HFC–134a	811–97–2	CH_2FCF_3	1,300
HFC–143	430–66–0	$C_2H_3F_3$	300
HFC–143a	420–46–2	$C_2H_3F_3$	3,800
HFC–152	624–72–6	CH_2FCH_2F	53
HFC–152a	75–37–6	CH_3CHF_2	140
HFC–161	353–36–6	CH_3CH_2F	12
HFC–227ea	431–89–0	C_3HF_7	2,900
HFC–236cb	677–56–5	$CH_2FCF_2CF_3$	1,340
HFC–236ea	431–63–0	CHF_2CHFCF_3	1,370
HFC–236fa	690–39–1	$C_3H_2F_6$	6,300
HFC–245ca	679–86–7	$C_3H_3F_5$	560
HFC–245fa	460–73–1	$CHF_2CH_2CF_3$	1,030
HFC–365mfc	406–58–6	$CH_3CF_2CH_2CF_3$	794
HFC–43–10mee	138495–42–8	$CF_3CFHCFHCF_2CF_3$	1,300
Sulfur hexafluoride	2551–62–4	SF_6	23,900
Trifluoromethyl sulphur pentafluoride	373–80–8	SF_5CF_3	17,700
Nitrogen trifluoride	7783–54–2	NF_3	17,200
PFC–116 (Perfluoroethane)	76–16–4	C_2F_6	9,200
PFC–218 (Perfluoropropane)	76–19–7	C_3F_8	7,000

Terminology

Carbon Dioxide Equivalent (CO_2e)

- PTE HFC-23 = 0.001 tpy

(0.001 tpy HFC-23) x (11,700) = 11.7 tpy CO_2e

GWP HFC-23

Greenhouse Gas Tailoring Rule

- Sets thresholds for GHG emissions that define when permits under the New Source Review Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs are required for new and existing sources.
- Phased in approach
  - Step 1: Jan-June 2011
  - Step 2: Began July 1, 2011

Step 1
January 2 – June 30, 2011

- **PSD**: A source with CO_2e increases of 75,000 tpy or more and needing a PSD permit because of another pollutant became subject to Best Available Control Technology (BACT) for GHG emissions.

- **Title V**: A source already subject to the program became subject to Title V permitting requirements for GHGs if major for GHGs.

Step 2
Beginning July 1, 2011

- **PSD Permit Required:**

  Any new source with emissions of 100,000 tpy or more of CO_2e and 100/250 tpy GHGs on a mass basis.

  Any modification at existing source that results in a net emissions increase of 75,000 tpy or more of CO_2e and 100/250 tpy GHGs on a mass basis.

Step 2
Beginning July 1, 2011

- **Title V Permit Required:**

  Existing or newly constructed GHG emission source with the Potential to Emit of at least 100,000 tons/yr CO_2e and 100 tons/yr GHGs on a mass basis.

  Title V application due 12 months from becoming a major source (July 1, 2012).

Step 3
July 1, 2012

- EPA to complete another rulemaking no later than July 1, 2012
- Purpose of rulemaking is to solicit comments on Step 3 of the rule's phase-in approach
  - Possible options include lower applicability threshold and permanent exclusion of certain sources
- Step 3 would then take effect July 1, 2013

Michigan Part 2 Rule Changes

- Rule 211 defines sources required to obtain a Title V Renewable Operating Permit (ROP)
- AQD amending Rule 211 to include GHGs to conform with the federal Tailoring Rule
- Also amending Rule 210
- Rule should be in place before the July 2012 due date for Title V ROP applications

What Does this Mean?

What Does this Mean?

- Facilities that were minor sources **may** now be considered **MAJOR** sources because of their GHG PTE.
  - Sources with large and/or multiple fuel combustion units
  - Sources with large refrigeration units, which utilize HFCs or PFCs (warehouses, food processing, etc)

Guidance for Fuel Combustion Equipment

Michigan Department of Environmental Quality, Air Quality Division

Greenhouse Gas Title V Permitting Guidance for Sources with Fuel Combustion Equipment

Is Your Business Affected by New Greenhouse Gas Permitting Requirements?

The Michigan Department of Environmental Quality (DEQ), Air Quality Division (AQD) issues permits to various businesses throughout the state that emit air contaminants. Under new federal regulations for greenhouse gases, many manufacturers, retailers, institutions, and other business may now be subject to air permitting under Title V of the Clean Air Act if their emissions of greenhouse gases exceed certain thresholds. This fact sheet has been developed to help you determine whether or not your business is affected by new greenhouse gas permitting requirements due to combustion equipment and, if so, what your options are to comply. It's important that you understand whether or not you are affected because you must take action before **July 1, 2012**.

This document only addresses combustion sources and is intended for facilities with fuel combustion units that are not already subject to the Renewable Operating Permit (ROP) Program based on emissions of criteria pollutants or hazardous air pollutants.

Does Your Business Emit Greenhouse Gases?

Greenhouse gases (GHGs) are considered the sum of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). GHGs are primarily emitted by the combustion of fossil fuels (including combustion of fuels by reciprocating engines), and other common processes, such as refrigeration. If you have any equipment that is listed in the table below, you generate GHGs and should determine your facility-wide potential to emit of GHGs.

The following sections of this document explain how to calculate your potential GHG emissions and determine if your facility is affected by the GHG permitting requirements under Title V of the Clean Air Act.

Examples of Common Equipment that Emit GHGs*

- ☐ Boilers
- ☐ Ovens and dryers
- ☐ Water heaters
- ☐ Space heaters
- ☐ Fire pumps

Equipment that is electrically powered does not emit GHGs on site and should not be included in your potential to emit calculations

Guidance for Fuel Combustion Equipment

1. Determine if GHGs are generated from fuel combustion units
2. Calculate source-wide PTE of GHGs on a mass and CO_2e basis
3. Compare to major source threshold for GHGs
4. Take appropriate action by July 1, 2012

Identify GHG Emitting Equipment

- **Equipment that generates GHGs**
  - Boilers
  - Ovens/dryers
  - Process heaters
  - Generators
  - Compressors
  - Fire pumps
  - Refrigeration

Facility Fuel Combustion GHG Worksheet

Use this worksheet to collect basic information about the fuel combustion devices/equipment that generate GHGs at your facility. This information will be used to calculate the potential to emit (PTE) of CO_2e for each device then totaled at the bottom for a facility-wide PTE.

Device Name[1]	Fuel[2]	Max Design Capacity[3] (MMBtu/hr, Btu/hr, kW)	Identified in an Air Permit?[4]	PTE GHG[5] Mass-basis (tons/yr)	PTE CO_2e[6] (tons/yr)
			☐ No ☐ Yes (enter permit number and limit)		
			☐ No ☐ Yes (enter permit number and limit)		
			☐ No ☐ Yes (enter permit number and limit)		
			☐ No ☐ Yes (enter permit number and limit)		
			☐ No ☐ Yes (enter permit number and limit)		
			☐ No ☐ Yes (enter permit number and limit)		
			☐ No ☐ Yes (enter permit number and limit)		
			Total GHG (mass and CO_2e)		
			Major Source Threshold	**100 tons/yr**	**100,000 tons/yr**

Facility Fuel Combustion GHG Worksheet

[1] Enter the name of this ... ing oven)

[2] Enter the fuel combusted (e.g, natural ...). If multiple fuels are burned, list the maximum amount of each fuel that could be used in the unit separately. Note that this may add up to more than 100%.

[3] Enter the maximum rated design capacity of the unit in Btu/hr, MMBtu/hr or kW. This information is normally located on the nameplate of the unit.

[4] If this device is identified in an air permit issued by the DEQ, check "yes", then enter the permit number and any associated limit on fuel usage or hours of operation contained in the permit for that device. This limit can be used in your PTE calculations (see calculation examples 3 and 4).

[5] Enter the PTE of GHG on a mass basis for the Device.

[6] Enter the PTE of CO_2e for the Device.

Calculate PTE GHG

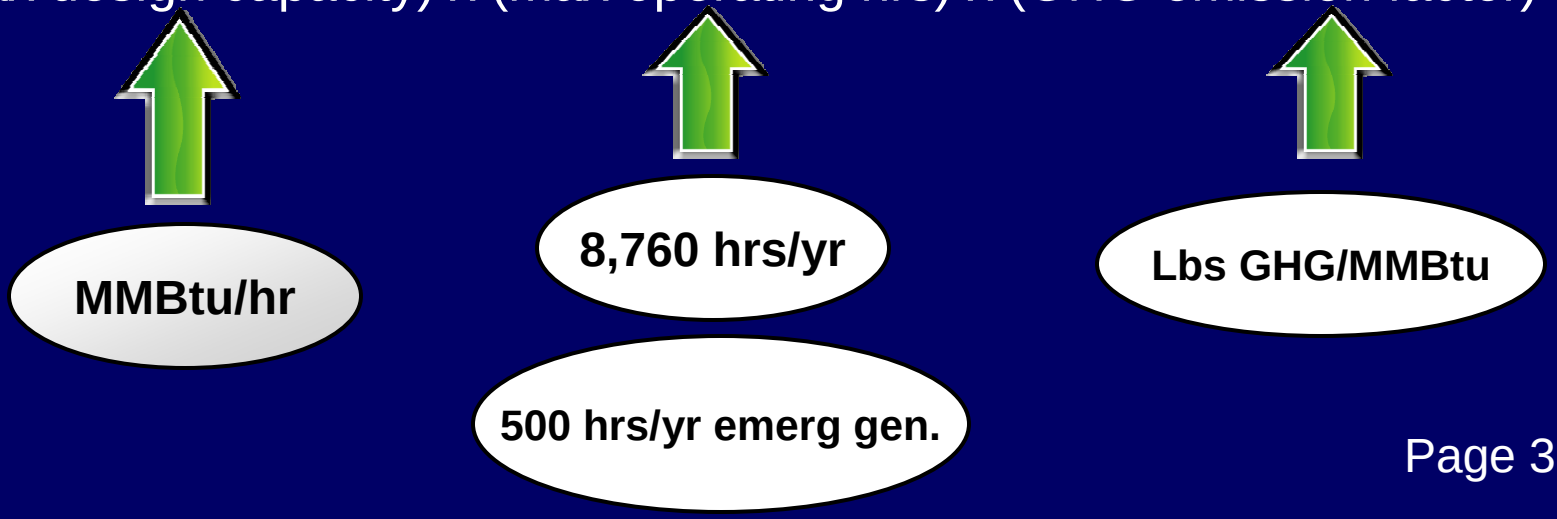
- Same PTE rules apply for GHGs as with other pollutants
  - Use maximum capacity
  - Worse-case fuels
  - Can only limit PTE through legally enforceable permit limits

Calculate PTE GHG

- Calculate the PTE of <u>each</u> GHG for <u>each</u> piece of equipment that generates a GHG (CO_2, N_2O, and CH_4)

GHG PTE =

(max design capacity) x (max operating hrs) x (GHG emission factor)



Calculate PTE GHG

- **Limiting PTE** = Facility may only limit PTE if they have an air permit that specifically limits the operating time or fuel usage rate for that piece of equipment.

$GHG_{pollutant}$ PTE =

(max fuel use) x (heating value) x (emission factor) x (max operating hrs)

$GHG_{pollutant}$ PTE =

(max design capacity) x (max operating hrs) x (emission factor)

Calculate PTE GHG

Table 1: High Heat Value and GHG Emission Factors for Stationary Combustion Sources

Use the emission factors in this table to calculate your potential to emit CO_2, CH_4, and N_2O as explained on page 2 of this document. The high heat values provided can be used to ca
where the unit has a permitted limit on fuel usage as shown in calculation

Natural Gas Emission factor for lbs CO_2 emitted per MMBtu

Fuel Type	Default High Heat Value	Em CO_2		
Natural Gas	**MMBtu/scf**	**lb CO_2/MMBtu**	**lb C MMBtu**	**lb N_2O/MMBtu**
Natural Gas	0.001028	116.89	0.0022	0.00022
Petroleum Products	**MMBtu/gallon**	**lb CO_2/MMBtu**	**lb CH_4/MMBtu**	**lb N_2O/MMBtu**
Distillate Oil No. 1	0.139	161.49	0.0066	0.0013
Distillate Oil No. 2	0.138	163.05	0.0066	0.0013
Distillate Oil No. 4	0.146	165.43	0.0066	0.0013
Residual Fuel Oil No. 5	0.140	160.78	0.0066	0.0013
Residual Fuel Oil No. 6	0.150	165.57	0.0066	0.0013
Used Oil	0.135	163.14	0.0066	0.0013
Kerosene	0.135	165.79	0.0066	0.0013
Liquefied Petroleum Gases	0.092	138.85	0.0066	0.0013

Calculate PTE GHG

Biomass Fuel Deferral

- Combustion devices that operate using biomass fuels such as landfill gas, wood, or corn do not have to include CO_2 emissions in PTE calculations from combusting these fuels
- The emission of CH_4 and N_2O must still be included

PTE GHG Mass-Basis

- Calculate the stationary combustion unit's PTE of GHG on a mass-basis
  - The mass-basis PTE is calculated by summing the PTE of each GHG emitted from the device.

$$GHG_{mass} = CO_2 + CH_4 + N_2O$$

PTE GHG CO_2e

- Also calculate CO_2e

CO_2e =
(GHG 1 x GWP1) + (GHG 2 x GWP2) + ... + (GHG n x GWPn)

Name	Chemical Formula	GWP
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous Oxide	N_2O	310

PTE GHG CO_2e

Tons CO_2e =

(26,622.87 x 1) + (0.50 x 21) + (0.05 x 310) = 26,648.87 tpy CO_2e

tons CO_2 x GWP

tons CH_4 x GWP

tons N_2O x GWP

Calculation Examples

EXAMPLE 3 – Emergency Generator

Calculate the PTE of GHGs in tons/yr on a mass-basis and CO_2e from a No. 2 Fuel oil (distillate) fired emergency generator with a name plate maximum design capacity of 700 kW. *Note: emergency generators can use 500 hrs/yr as the maximum hours of operation. 1 kW = 3.412.14 Btu/hr.*

1. Convert kW to MMBtu/hr

Note that conversion from kW to MMBtu/hr should account for the efficiency of the generator in converting input energy to kW output. For purposes of PTE calculations, assume an engine efficiency of 65% in converting energy input Btu/hr to generate the listed nameplate kW output. A conversion factor of 1/0.65 is used to account for this in equation below (a different efficiency factor can be used if provided by the engine manufacturer).

$$\frac{\text{MMBtu}}{\text{hr}} = 700\ \text{kW} \times \frac{3{,}412.14\ \text{Btu/hr}}{\text{kW}} \times \frac{1\ \text{MMBtu}}{1{,}000{,}000\ \text{Btu}} \times \frac{1}{0.65} = \frac{3.67\ \text{MMBtu}}{\text{hr}}$$

2. Calculate PTE of CO_2, CH_4, and N_2O (tons/yr)

$$CO_2 = \frac{3.67\ \text{MMBtu}}{\text{hr}} \times \frac{500\ \text{hrs}}{\text{yr}} \times \frac{163.05\ \text{lbs}\ CO_2}{\text{MMBtu}} \times \frac{1\ \text{ton}}{2{,}000\ \text{lbs}} = \textbf{149.60 tons/yr } \boldsymbol{CO_2}$$

$$CH_4 = \frac{3.67\ \text{MMBtu}}{\text{hr}} \times \frac{500\ \text{hrs}}{\text{yr}} \times \frac{0.0066\ \text{lbs}\ CH_4}{\text{MMBtu}} \times \frac{1\ \text{ton}}{2{,}000\ \text{lbs}} = \textbf{0.006 tons/yr } \boldsymbol{CH_4}$$

$$N_2O = \frac{3.67\ \text{MMBtu}}{\text{hr}} \times \frac{500\ \text{hrs}}{\text{yr}} \times \frac{0.0013\ \text{lbs}\ N_2O}{\text{MMBtu}} \times \frac{1\ \text{ton}}{2{,}000\ \text{lbs}} = \textbf{0.001 tons/yr } \boldsymbol{N_2O}$$

3. Calculate PTE of GHG tons/yr mass-basis

GHGmass = 149.60 tons CO_2 + 0.006 tons CH_4 + 0.001 tons N_2O = **149.61 tons/yr GHG**

4. Calculate PTE of GHG tons/yr CO_2e

Tons CO_2e = (149.60 x 1) + (0.006 x 21) + (0.001 x 310) = **150.04 tons/yr CO_2e**

EXAMPLE 4 – Oil-fired Generator with Permit Limit on Fuel Usage

Calculate the PTE of GHGs in tons/yr on a mass-basis and CO_2e from a generator with a maximum fuel usage rate of 50 gallons No.6 residual fuel oil per hour. Note: *Heating value of No.6 residual fuel oil = 0.150 MMBtu/gal*

1. Calculate PTE of CO_2, CH_4, and N_2O (tons/yr)

Calculate PTE GHG

- Determine facility-wide PTE of CO_2e and of GHGs on a mass-basis

EXAMPLE **EXAMPLE**

Facility Fuel Combustion GHG Worksheet

Use this worksheet to collect basic information about the fuel combustion devices/equipment that generate GHGs at your facility. This information will be used to calculate the potential to emit (PTE) of CO_2e for each device then totaled at the bottom for a facility-wide PTE.

Device Name[1]	Fuel[2]	Max Design Capacity[3] (MMBtu/hr, Btu/hr, kW)	Identified in an Air Permit?[4]	PTE GHG[5] Mass-basis (tons/yr)	PTE CO_2e[6] (tons/yr)
Boilers 1, 2, 3	Nat Gas	52 MMBtu/hr (total for 3 boilers)	☒ No ☐ Yes (enter permit number and limit)	26,623.42	26,648.87
Wood Boiler	Wood	1,000,000 Btu/hr	☒ No ☐ Yes (enter permit number and limit)	0.35	18.91
Emergency Generator	#2 fuel oil	700 kW (3.67 MMBtu/hr)	☒ No ☐ Yes (enter permit number and limit)	149.61	150.04
Generator	#6 fuel oil	50 gal/hr	☒ No ☐ Yes (enter permit number and limit)	5,439.23	5,456.86
Coating oven 1	Nat Gas	3.5 MMBtu/hr	☐ No ☒ Yes (enter permit number and limit) PTI #555-87, 4 hrs/day	298.66	299.09
			☐ No ☐ Yes (enter permit number and limit)		
			☐ No ☐ Yes (enter permit number and limit)		
			Total GHG (mass and CO_2e)	32,511.27	32,573.77
			Major Source Threshold	100 tons/yr	100,000 tons/yr

Since facility does not exceed BOTH thresholds it is NOT a major source of GHG.

[1] Enter the name of the GHG emitting device (e.g. boiler 1, generator 2, coating oven)

[2] Enter the fuel combusted (e.g, natural gas, propane, fuel oil). If multiple fuels are burned, list the maximum amount of each fuel that could be used in the unit separately. Note that this may add up to more than 100%.

[3] Enter the maximum rated design capacity of the unit in Btu/hr, MMBtu/hr or kW. This information is normally located on the nameplate of the unit.

[4] If this device is identified in an air permit issued by the DEQ, check "yes", then enter the permit number and any associated limit on fuel usage or hours of operation contained in the permit for that device. This limit can be used in your PTE calculations (see calculation examples 3 and 4).

[5] Enter the PTE of GHG on a mass basis for the Device.

[6] Enter the PTE of CO_2e for the Device.

Compare to Major Source Threshold

- **Major Source = source-wide PTE GHGs equal to or greater than**
  - **100 tpy GHG on a mass-basis**

  and

  - **100,000 tpy CO_2e**

Compliance Options

If Major, source must do one of the following by July 1, 2012

- Apply for ROP
- Become true minor source of GHGs
- Obtain opt-out permit (submit application ASAP to allow time for processing)

Compliance Options

Opt Out Permit

- Cover Letter
- PTI Application Form
- PTE Calculations
- Actual Emission Calculations
- Summary of Facility Wide Emissions
- Proposed Enforceable Limits

Title V ROP

- Sources with Existing ROP – no application needed
- Newly Subject ROP Sources Due to GHGs – ROP application must include all applicable requirements under the Clean Air Act and Act 451

Federal Mandatory GHG Reporting rule is not an applicable requirement under Title V

Review

- Identify sources with GHG emissions
  - Large or multiple combustion units
  - Large refrigeration units using fluocarbons - warehouses, food processing
  - Landfills, waste processing, and wastewater treatment
- Calculate PTE GHG
- Determine if Minor or Major Source of GHGs
- Comply as necessary

FAQs

- **Are there any rules of thumb related to the GHG PTE Thresholds?**

Capacity and Fuel Usage Thresholds*		
Fuel Type	**Total Capacity for Entire Facility**	**Total Potential Fuel Use for entire facility**
Natural Gas	195 mmBtu/hr	1,650 mmcf/yr
Fuel Oil (No. 2)	140 mmBtu/hr	8,900,000 gal/yr
Gasoline	147 mmBtu/hr	10,250,000 gal/yr

*Based on generally applicable emission factors. Maximum design capacity and/or fuel use rate for each piece of equipment can be found on the nameplate of the device or in manufacturer data.

FAQs

- Can you use an existing emission limit to limit your PTE of a GHG?

FAQs

- How do you calculate GHG PTE for dual fuel fired equipment?

FAQs

- **How do you calculate PTE of GHGs for refrigeration equipment?**
  - Include refrigerants that are GHGs - hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs)
  - AQD GHG Permitting website www.deq.state.mi.us/aps/downloads/ghg/GHG.shtml

FAQs

- Do I need to include fugitive emissions in my PTE calculation?

Resources

- DEQ, AQD GHG Permitting Page www.michigan.gov/air "GHG Emissions Regulations and Permitting"
- PSD and Title V Permitting Guidance for Greenhouse Gases – Updated March 2011 www.epa.gov/nsr/ghgpermitting.html

Resources

- Questions regarding Title V Permitting - **Contact your AQD Inspector**
- Questions about NSR permitting -

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Questions?